SysML 2.0 Interface Concepts Modeling Core Team

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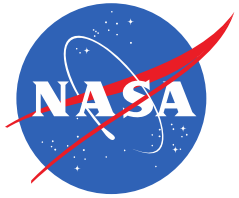


Primary Goals for Interface Modeling

- The information captured in the model includes equivalent information that is generally contained in an interface specification document and interface design document (e.g. IRS, IDD, ICD, ...)
- The interface concepts are consistent with the behavior, structure, and other concepts of the language
- The concepts of interface specification and interface realization are distinct such that the model can clearly capture how interface specifications can be realized.
- Ensure a consistent approach to model a diverse range of interfaces (e.g. electrical, mechanical, software, user IF), and include the ability to model Modelica-like physical interface concepts and flow based concepts
- Ensure ability to support nested interfaces and reusable interfaces
- Ensure the ability to readily model different interface viewpoints that address a broad range of interface concerns

Context

- Elaborate Interface Concept Model in context of Structure WG
- Incorporate concepts from prior interface modeling work

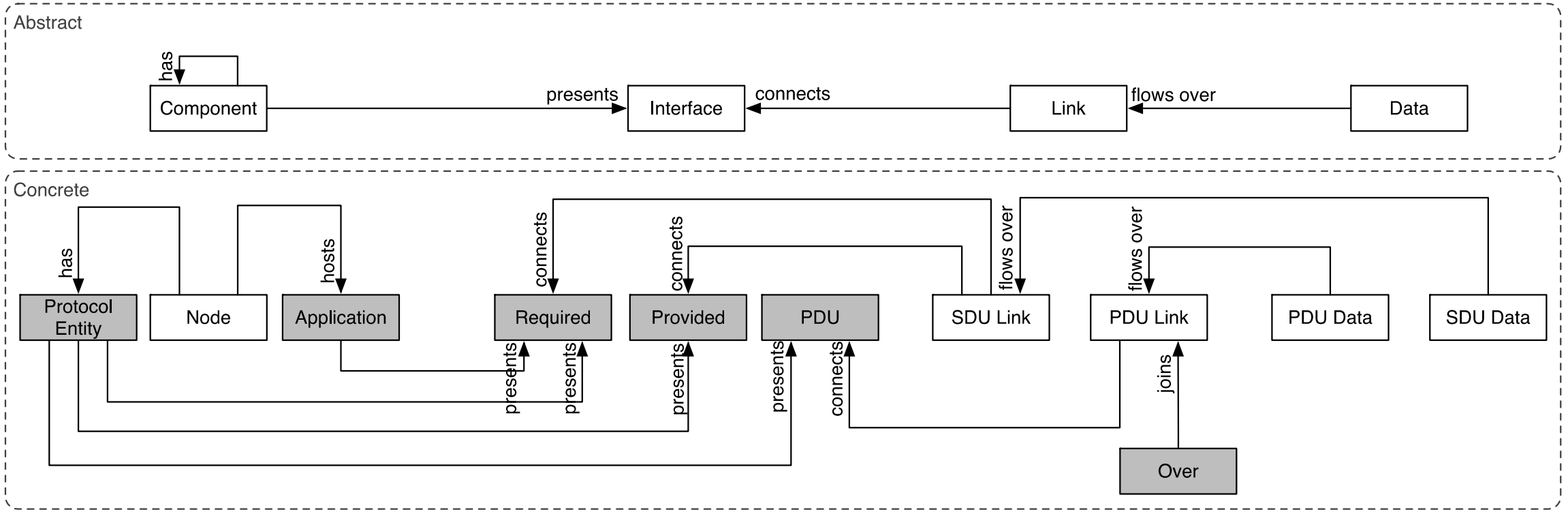
- From interface needs document there are three orthogonal dimensions
  - Interface Definition vs Interface Usage
  - Interface Specification vs Realization
  - Interface Layers (e.g. OSI protocol layers)
  - Levels of Abstraction (e.g. showing and hiding detail and intermediate systems)

- Will address first three.
- Assume that Levels of Abstraction is handled by Visualization and Model Construction groups.

Definition of Interface

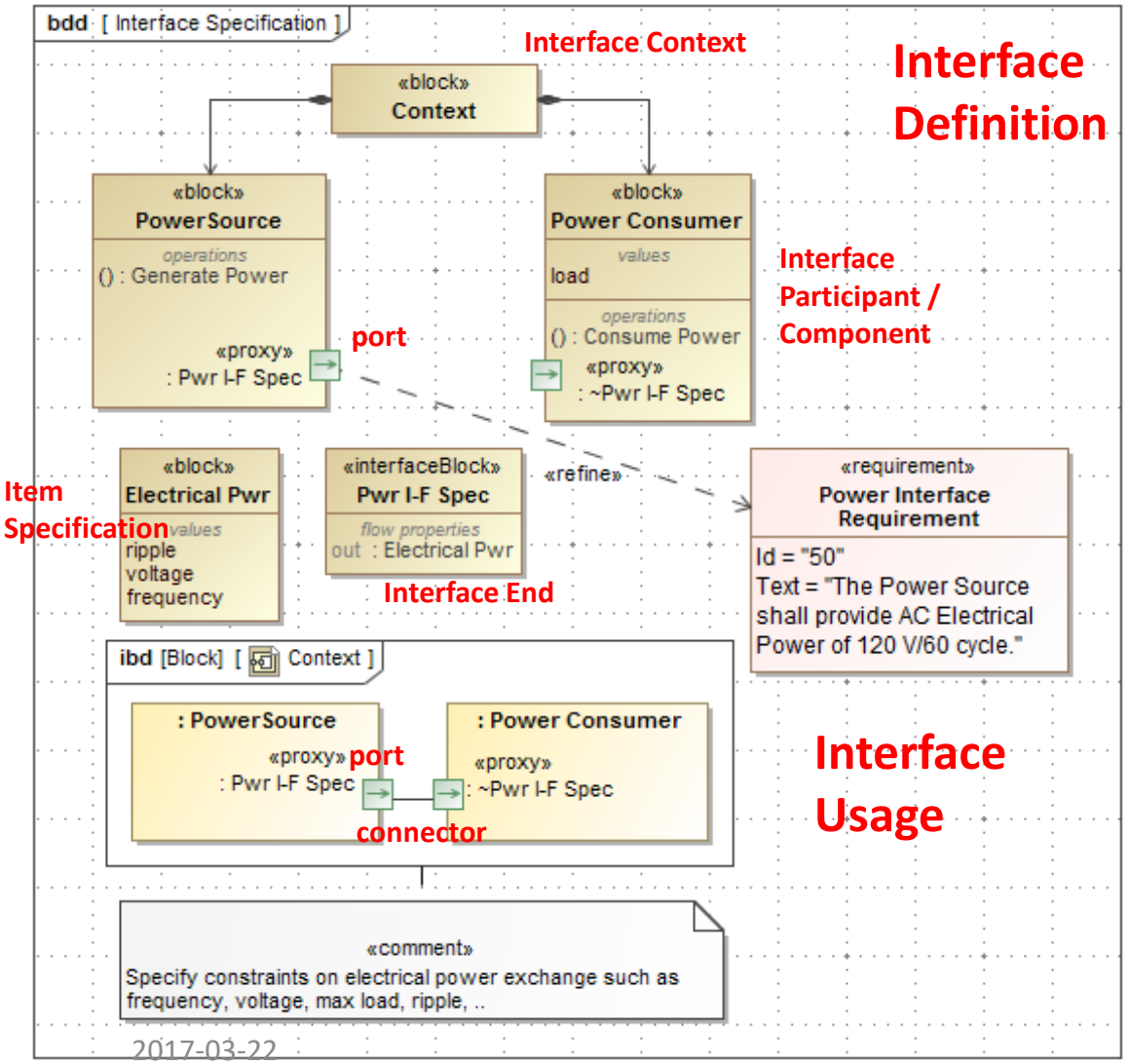
- We take the definition of an interface to include:
  - The things on either end
  - The connection between them

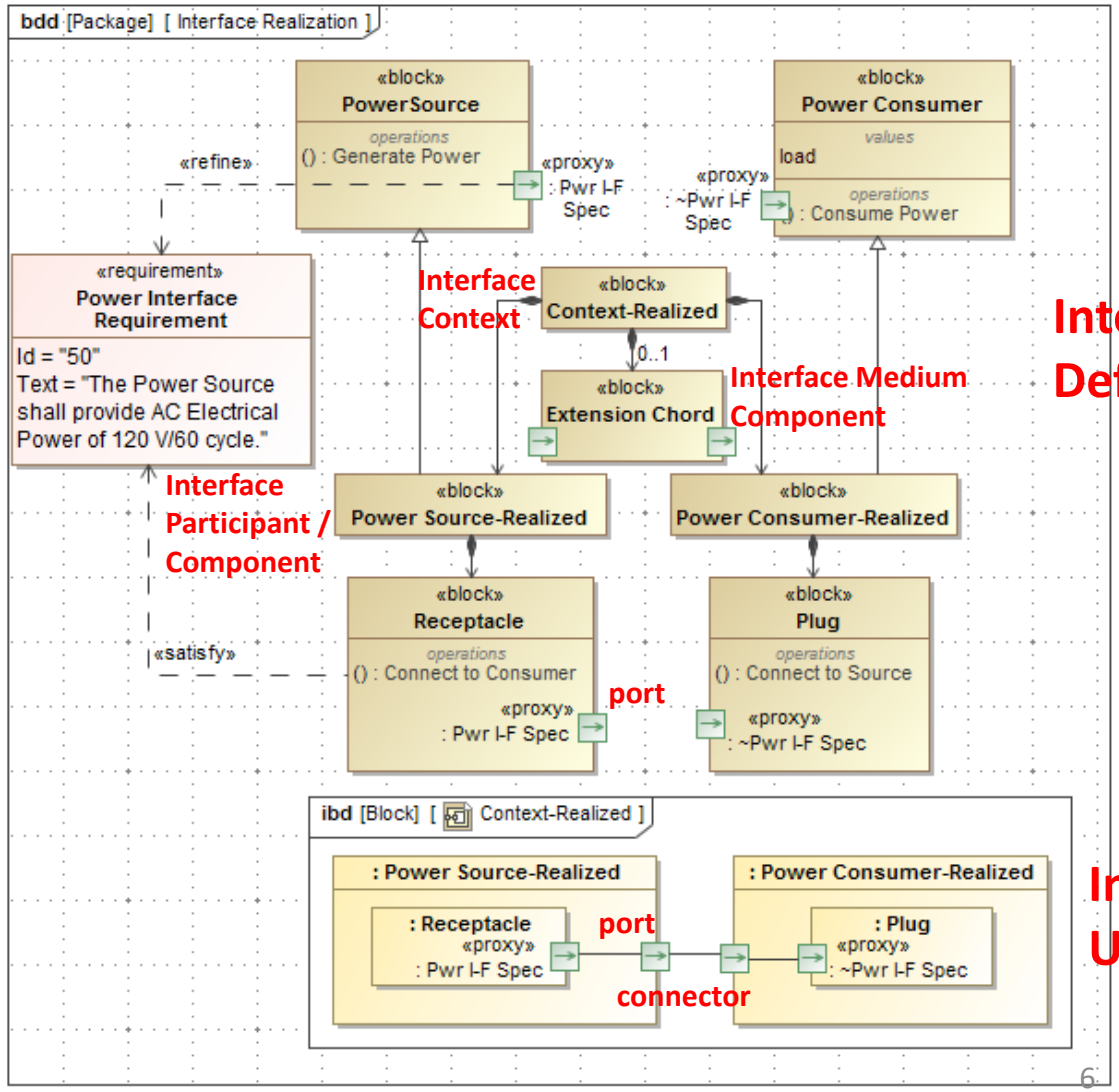
- This applies both for the Interface Definition and the Interface Usage

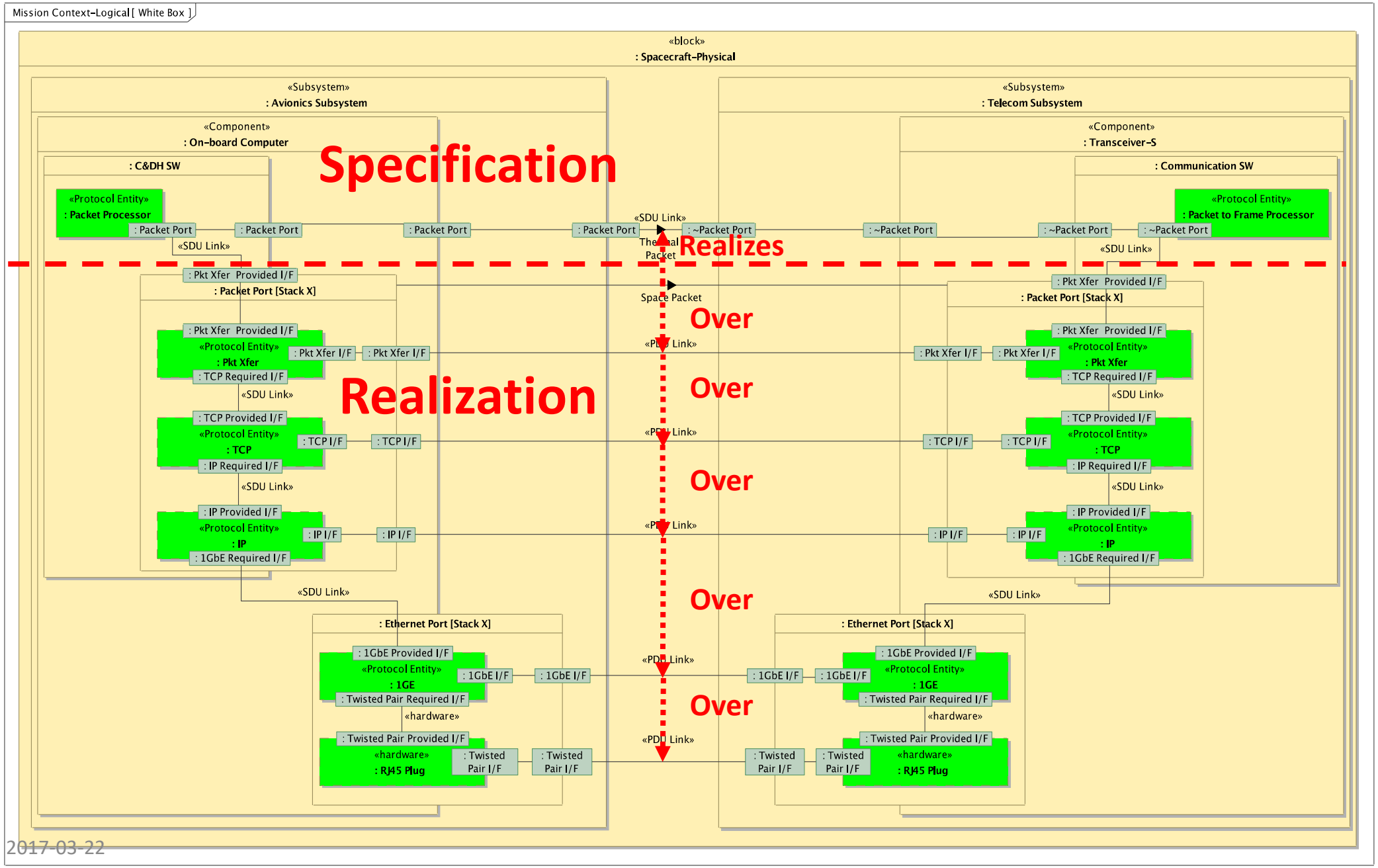

Abstract
has
Component
presents
Interface
connects
Link
flows over
Data
Concrete
has
Protocol Entity
Node
hosts
Application
connects
Required
connects
Provided
PDU
SDU Link
flows over
flows over
PDU Link
PDU Data
SDU Data
presents
presents
presents
presents
connects
joins
Over

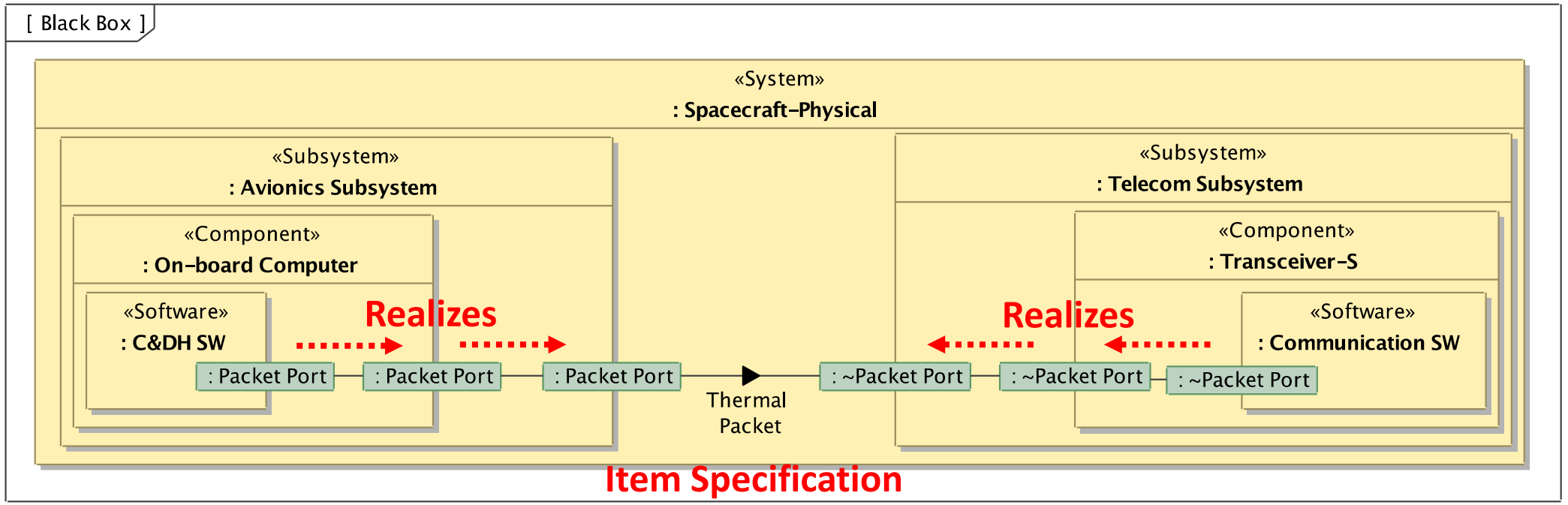
Specification vs Realization

Have changed concept model in this area. No longer have separate concepts for specification and realization.

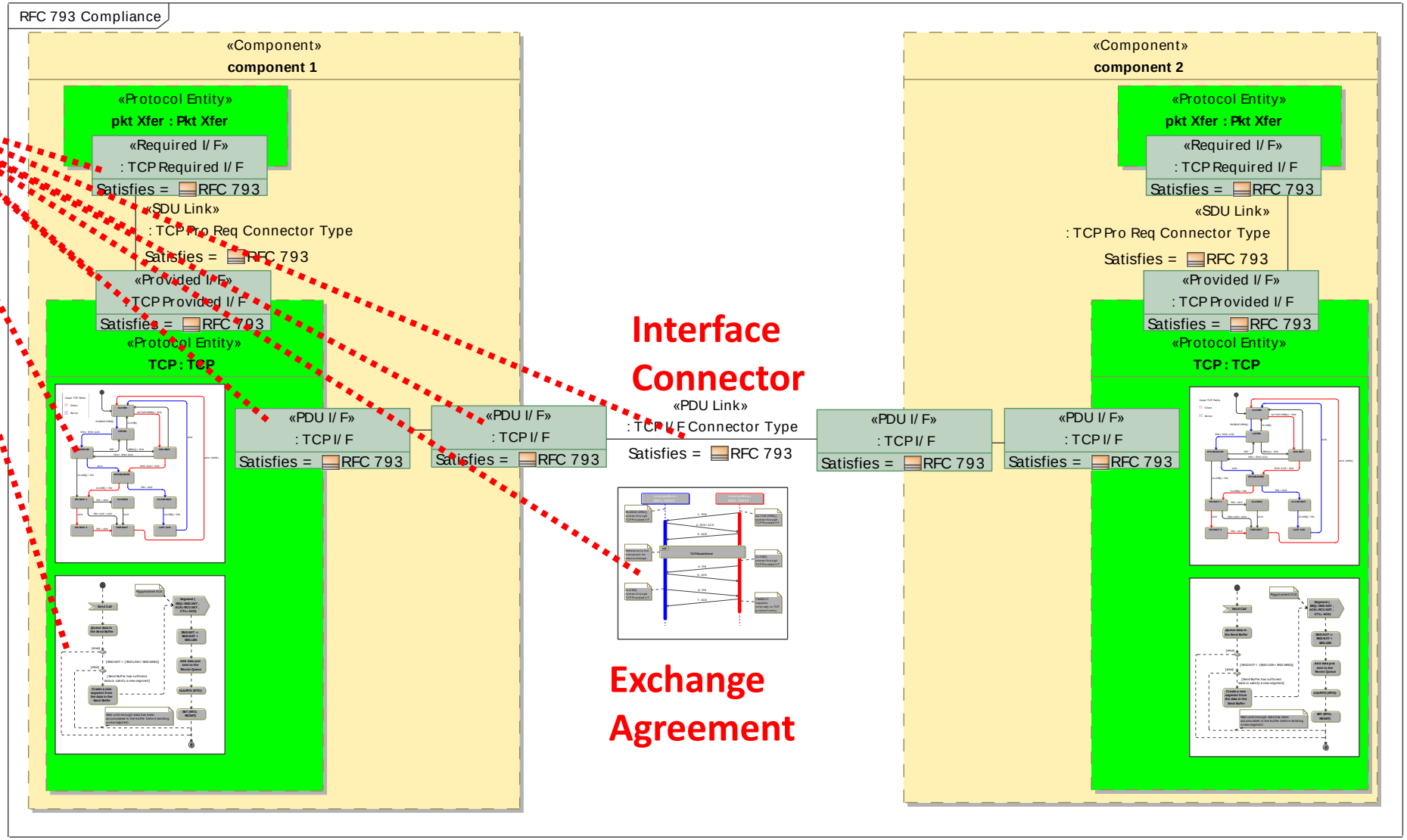





Mission Context-Logical [White Box]
«block»
: Spacecraft-Physical
«Subsystem»
: Avionics Subsystem
«Component»
: On-board Computer
: C&DH SW
«Protocol Entity»
: Packet Processor
: Packet Port
: Packet Port
: Packet Port
: Packet Port
«SDU Link»
: Pkt Xfer Provided I/F
: Packet Port [Stack X]
: Pkt Xfer Provided I/F
«Protocol Entity»
: Pkt Xfer
: Pkt Xfer I/F
: Pkt Xfer I/F
: TCP Required I/F
«SDU Link»
: TCP Provided I/F
«Protocol Entity»
: TCP
: TCP I/F
: TCP I/F
: IP Required I/F
«SDU Link»
: IP Provided I/F
«Protocol Entity»
: IP
: IP I/F
: IP I/F
: 1GbE Required I/F
«SDU Link»
: Ethernet Port [Stack X]
: 1GbE Provided I/F
«Protocol Entity»
: 1GE
: 1GbE I/F
: 1GbE I/F
: Twisted Pair Required I/F
«hardware»
: Twisted Pair Provided I/F
«hardware»
: RJ45 Plug
: Twisted Pair I/F
: Twisted Pair I/F
«SDU Link»
: ~Packet Port
Thermal Packet
Space Packet
«PDU Link»
«PDU Link»
«PDU Link»
«PDU Link»
«Subsystem»
: Telecom Subsystem
«Component»
: Transceiver-S
: Communication SW
«Protocol Entity»
: Packet to Frame Processor
: ~Packet Port
: ~Packet Port
: ~Packet Port
«SDU Link»
: Pkt Xfer Provided I/F
: Packet Port [Stack X]
: Pkt Xfer Provided I/F
«Protocol Entity»
: Pkt Xfer
: Pkt Xfer I/F
: Pkt Xfer I/F
: TCP Required I/F
«SDU Link»
: TCP Provided I/F
«Protocol Entity»
: TCP
: TCP I/F
: TCP I/F
: IP Required I/F
«SDU Link»
: IP Provided I/F
«Protocol Entity»
: IP
: IP I/F
: IP I/F
: 1GbE Required I/F
«SDU Link»
: Ethernet Port [Stack X]
: 1GbE Provided I/F
«Protocol Entity»
: 1GE
: 1GbE I/F
: 1GbE I/F
: Twisted Pair Required I/F
«hardware»
: Twisted Pair Provided I/F
«hardware»
: RJ45 Plug
: Twisted Pair I/F
: Twisted Pair I/F
Specification
Realizes
Realization
Over
Over
Over
Over


[Black Box]
«System»
: Spacecraft-Physical
«Subsystem»
: Avionics Subsystem
«Component»
: On-board Computer
«Software»
: C&DH SW
: Packet Port
: Packet Port
: Packet Port
Realizes
Thermal
Packet
: ~Packet Port
: ~Packet Port
: ~Packet Port
Realizes
«Subsystem»
: Telecom Subsystem
«Component»
: Transceiver-S
«Software»
: Communication SW
Item Specification

Component



RFC 793

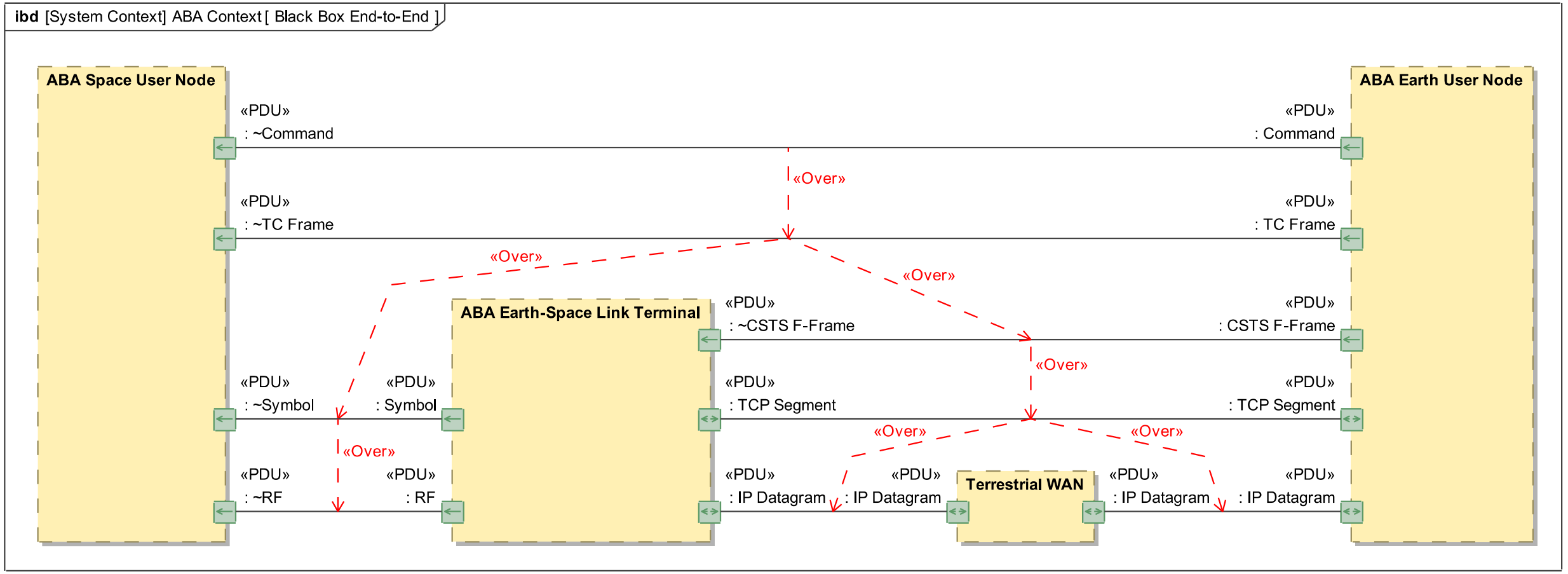
Realizes

Component Behavior

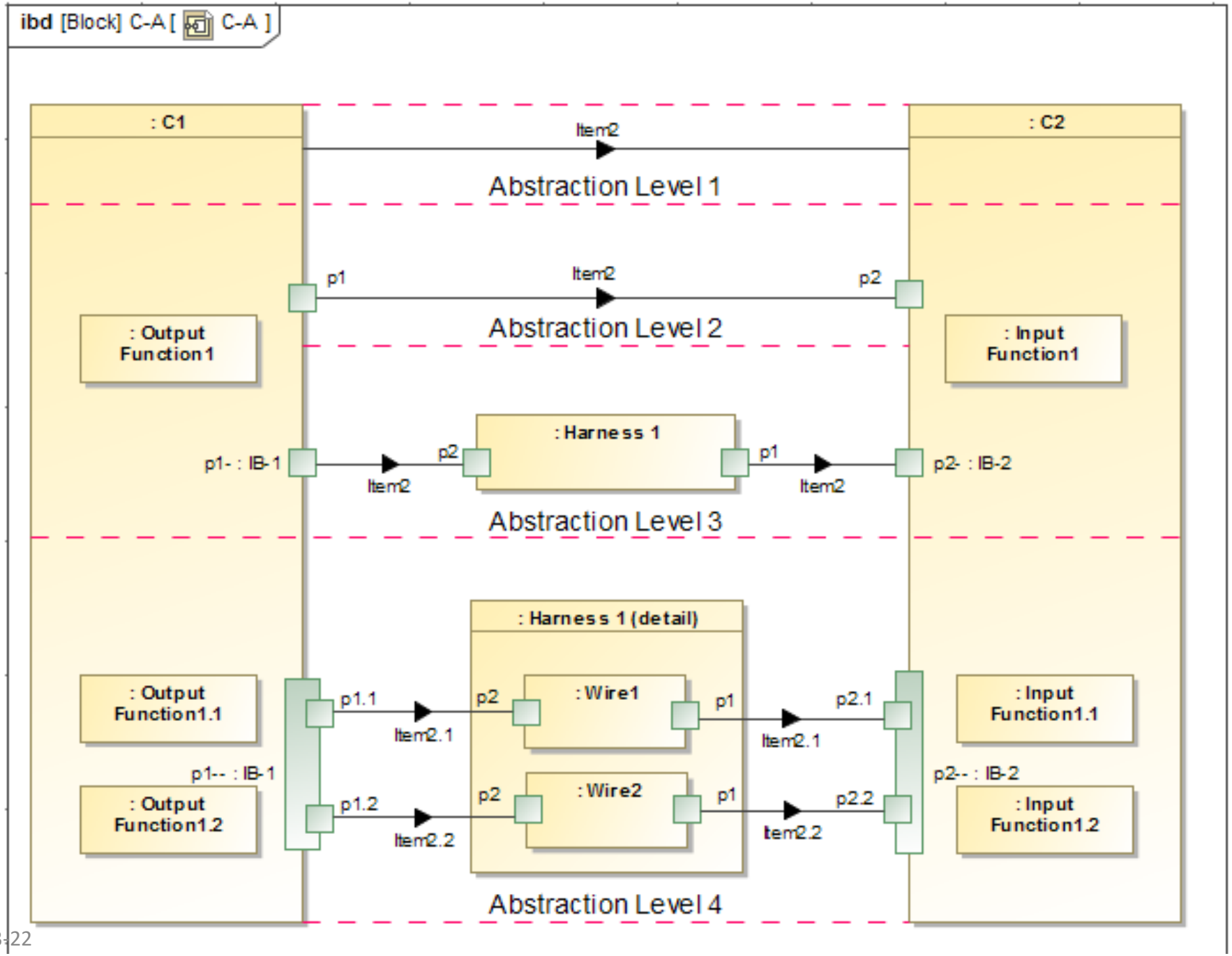
Interface Connector

Exchange Agreement

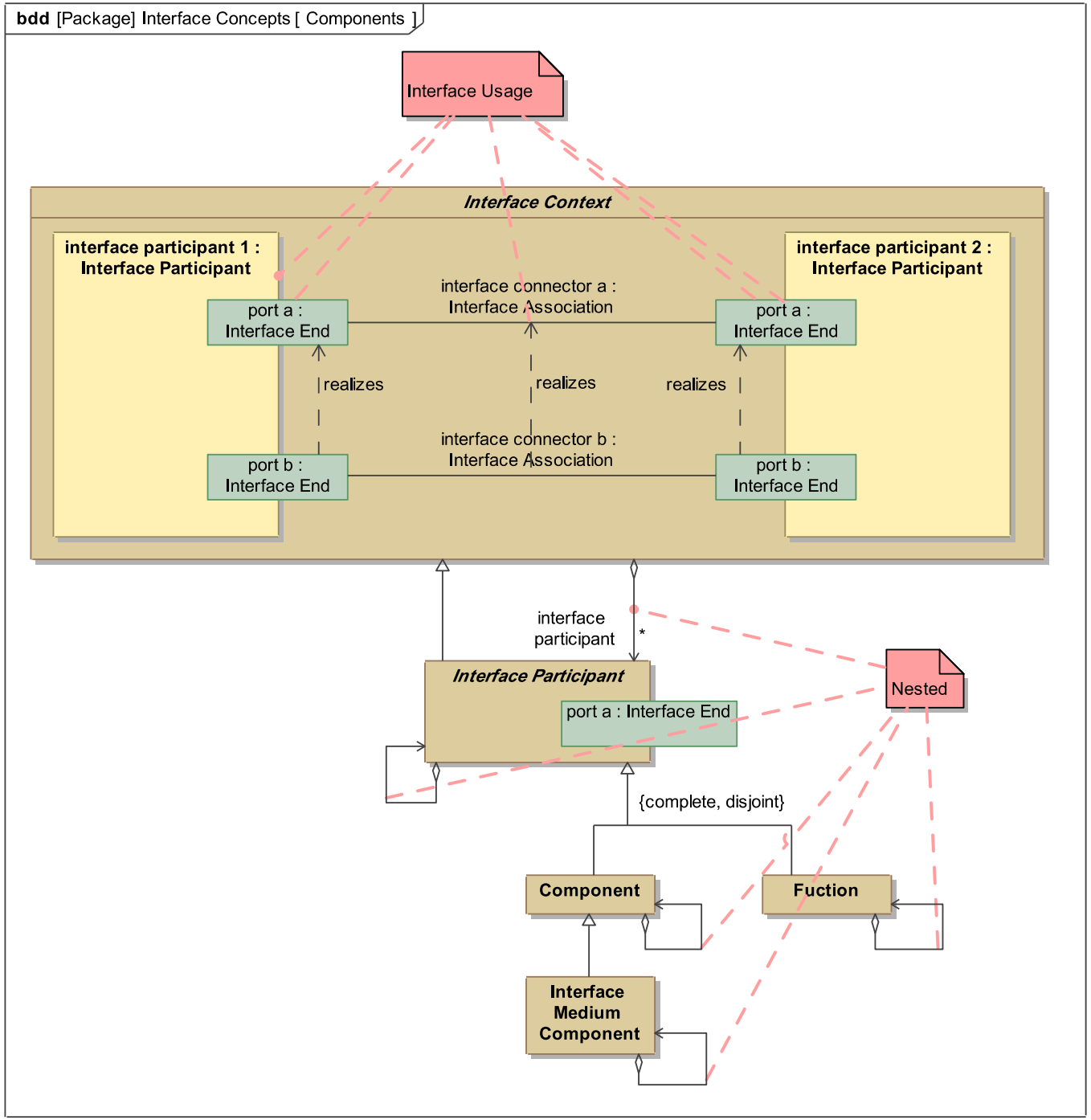
Interface Layers



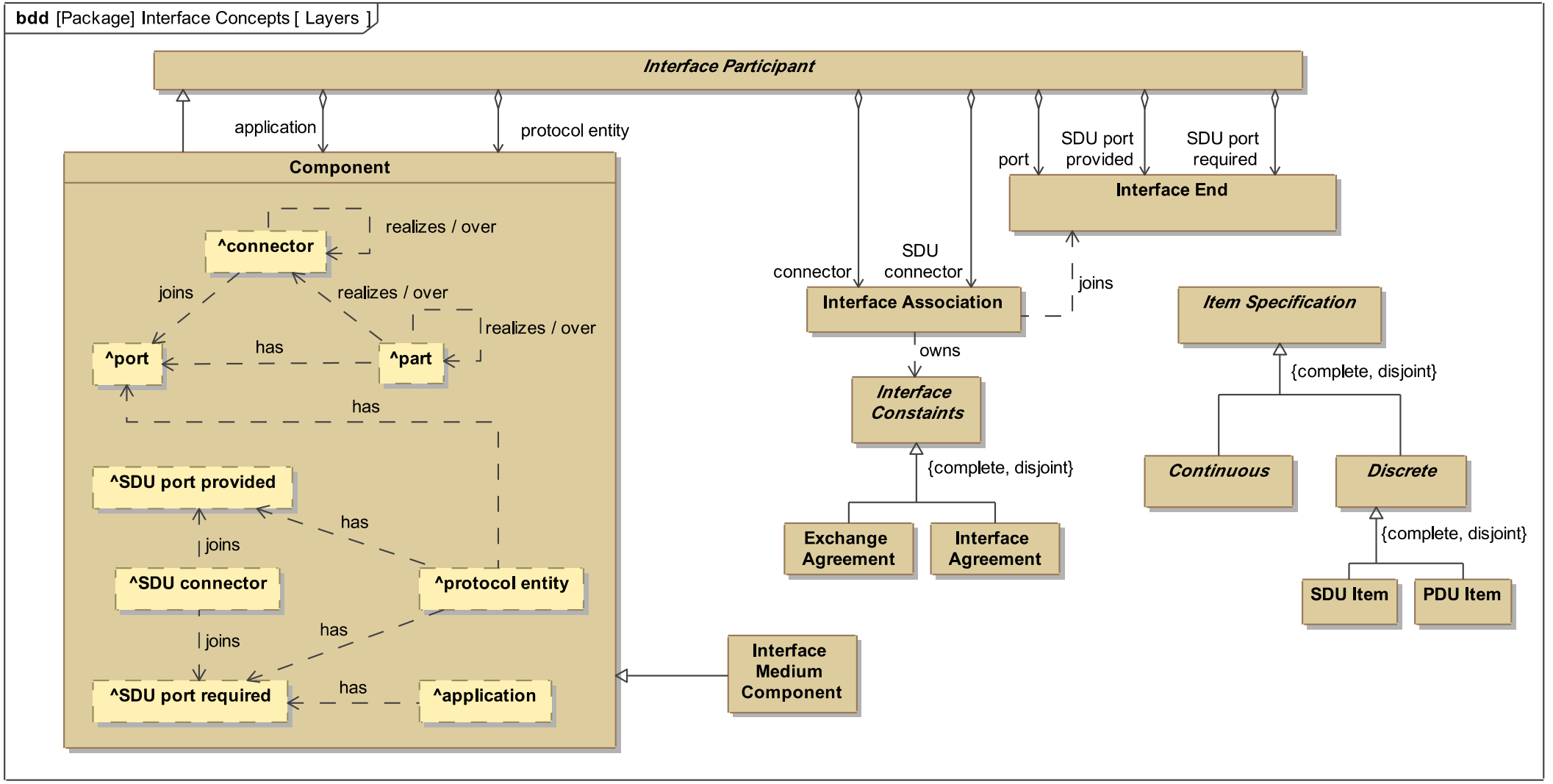
Levels of Abstraction



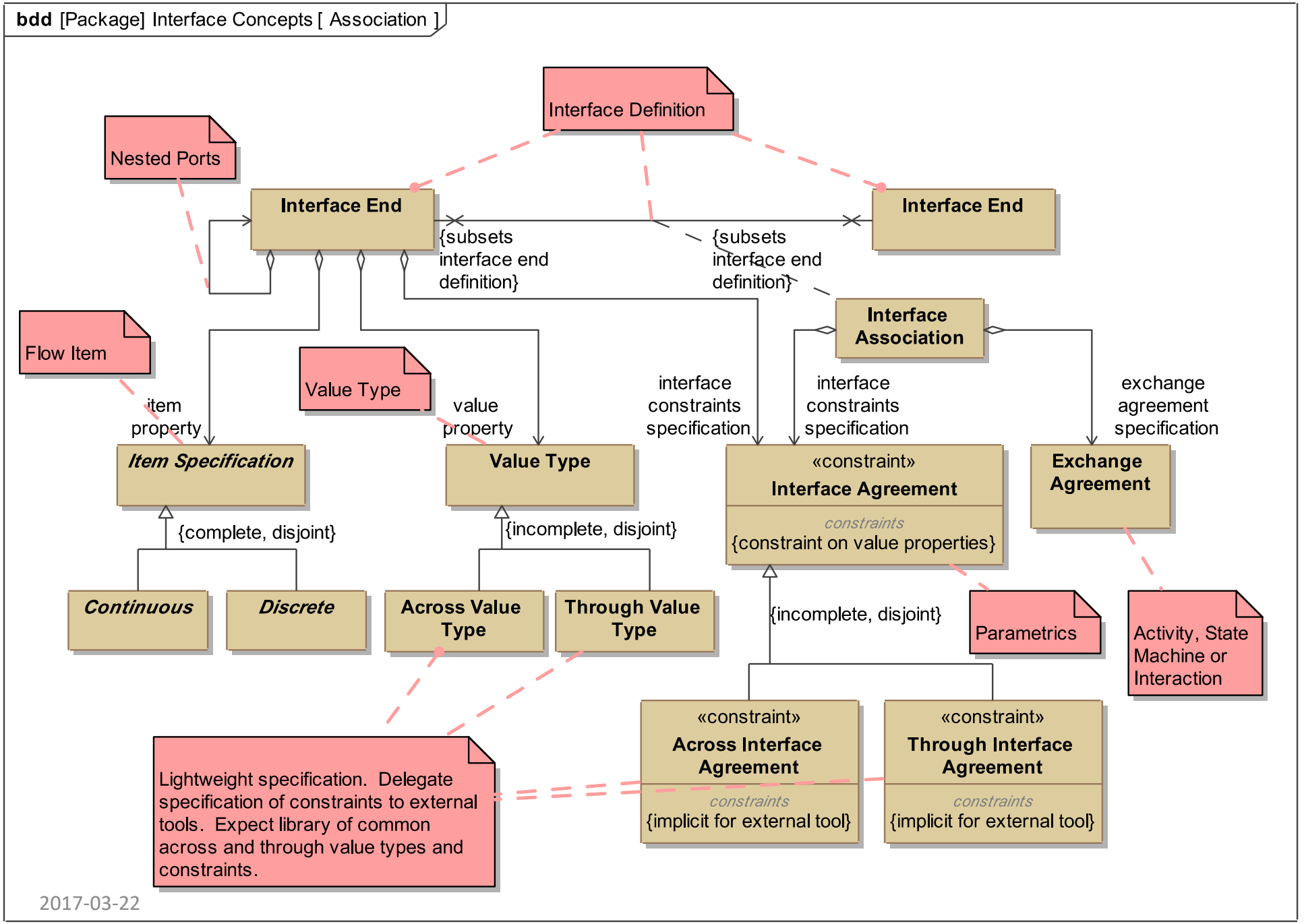
Interface Concept Model 1



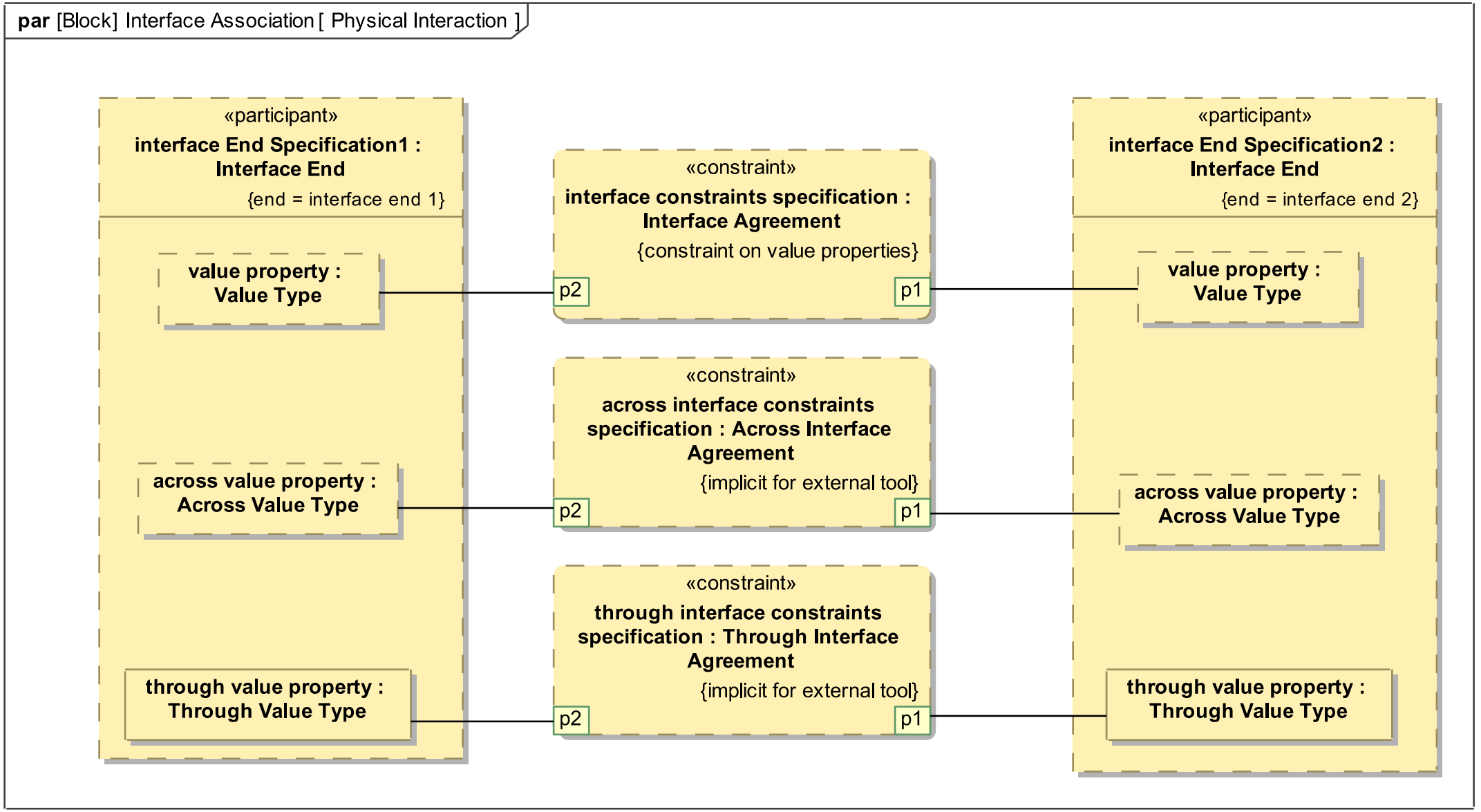
Interface Concept Model 2



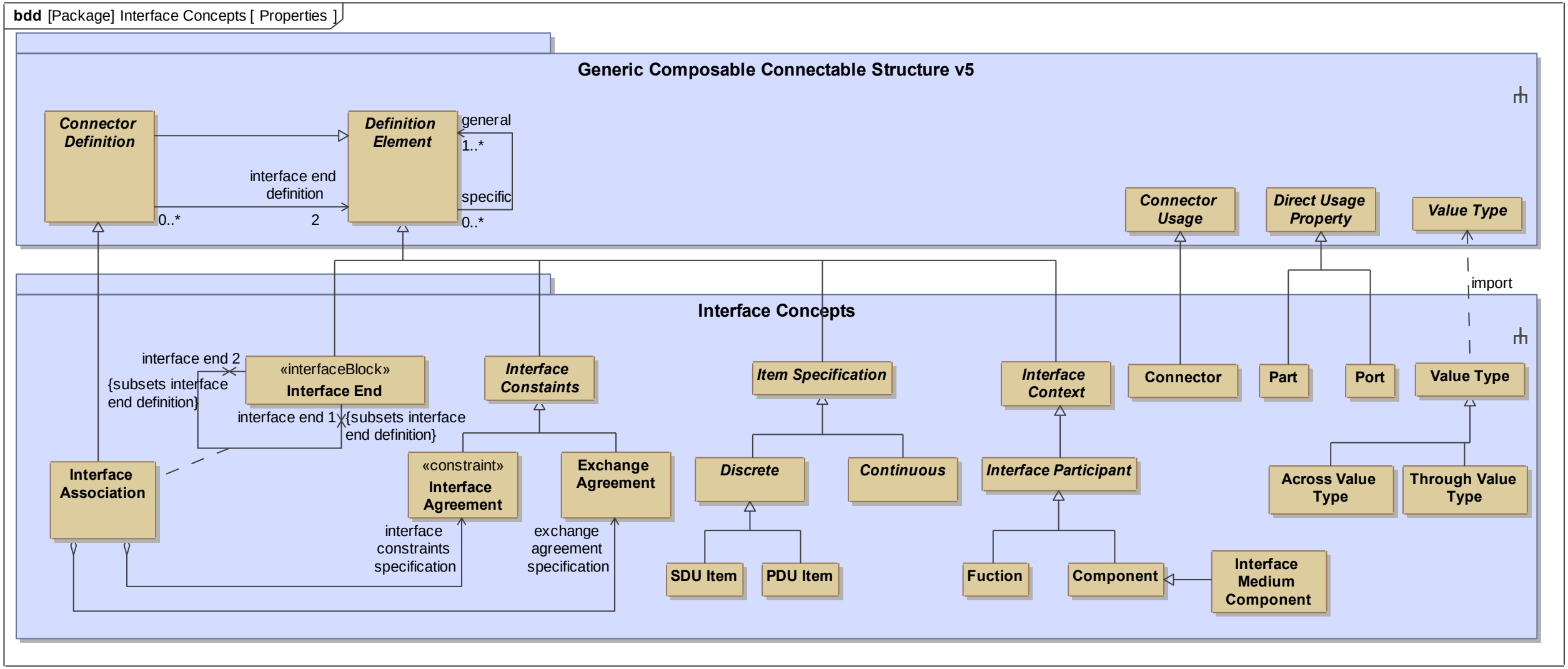
Interface Concept Model 3



Interface Concept Model 4



Mapping to Structure Concepts



Interface Requirements 1

- **Interface Context** The SysML v2 specification shall represent an Interface Context that allows the assembly and connection of Interface Participants and Interface Agreements.
- **Interface Participant** The SysML v2 specification shall represent an Interface Participant as a special kind of Interface Context that present Interface Ends and may be connected to other Interface Participants.
- **Component** The SysML v2 specification shall represent a Component as a special kind of Interface Participant that models a real item, either physical or logical.
- **Interface Medium Component** The SysML v2 specification shall represent an Interface Medium Component as a special kind of Component that models an interface medium.
- **Function** The SysML v2 specification shall represent a Function as a special kind of Interface Participant that models an abstract function.

Interface Requirements 2

- **Interface Association** The SysML v2 specification shall represent an Association that defines the which Interface Participants may be connected.
- **Interface End** The SysML v2 specification shall represent an Interface End that defines the specification presented to other Interface Participants, and defines to which Associations an Interface Participant may be connected.
- **Interface Constraint** The SysML v2 specification shall represent an Interface Constraint that constrains the interactions between Interface Participants.
- **Interface Agreement** The SysML v2 specification shall represent an Interface Agreement as a special kind of Interface Constraint that defines the mathematical parametric relationships between Interface Participants.
- **Exchange Agreement** The SysML v2 specification shall represent an Exchange Agreement as a special kind of Interface Constraint that defines when and how Item Specifications are exchanged between Interface Participants.

Interface Requirements 3

- **Item Specification** The SysML v2 specification shall represent an Item Specification that defines the items that may be exchanged according to an Exchange Agreement.
- **Across Value Type** The SysML v2 specification shall represent an Across Value Type, a special kind of Value Type (from structure) that defines across values.
- **Through Value Type** The SysML v2 specification shall represent an Through Value Type, a special kind of Value Type (from structure) that defines across values.
- **Across Interface Agreement** The SysML v2 specification shall represent an Across Interface Agreement as a special kind of Interface Agreement that defines the mathematical parametric relationships between Across Value Types of Interface Participants.
- **Through Interface Agreement** The SysML v2 specification shall represent a Through Interface Agreement as a special kind of Interface Agreement that defines the mathematical parametric relationships between Through Value Types of Interface Participants.

Interface Requirements 4

- **Realizes** The SysML v2 specification shall represent a Realizes relation that defines how an abstract interface usage is reified by a more concrete interface usage.
- **Over** The SysML v2 specification shall represent an Over relation, that specifies how an interface usage at an upper layer of a layered interface is transformed into an interface usage at a lower layer between Interface Participants.